

ferred that he contemplates as at least a high probability that they originate from like causes. Moreover, in the paragraph quoted above, he refers to myself as an upholder of the condensation theory, in terms that seem to imply that he regards me as an opponent, the fact being that I have never contended that this theory is applicable to the case of other than tropical cyclones, or, to be exact, of other than those of Indian seas. To this contention I must still adhere; but as the discussion of the question would unduly extend the limits of this notice, I reserve it for another occasion. HENRY F. BLANFORD.

ON THE ANATOMY AND DEVELOPMENT OF APTERYX.

IN a paper read before the Royal Society on April 17 of this year, Prof. T. Jeffery Parker, F.R.S., of Otago University, gives an account of his researches on the anatomy and development of the Kiwi (*Apteryx*) which are of especial interest, as so few detailed observations have been recorded on the development of any of the flightless birds (*Ratitæ*). Moreover, the comparisons which are given of the different species of *Apteryx*; the account of the sexual differences, and the variations seen within the same species; and the tables showing the relative proportions of the various regions of the body in different stages of development, illustrating the "law of growth," add greatly to our knowledge of this remarkable genus. A number of new terms are proposed in the description of the skeleton, and a new method of writing the vertebral formula of birds is adopted. Notes are given with regard to the presence of uncinatæ processes and to the structure of the foot in *Dinornis*.

The chief materials on which the investigation is based consist of a number of embryos of the three common species of *Apteryx*, which naturally group themselves into ten stages (A-K); an eleventh stage (L) is furnished by a bird a few weeks old, a twelfth (M) by the skeleton of an adolescent specimen, and a thirteenth (N) and fourteenth (O) by odd bones of young birds; the adult may be considered as constituting a fifteenth stage. The embryos were, for the most part, well preserved, but not sufficiently well for the purposes of exact histological study. The single embryo belonging to stage A corresponds in most respects to a chick of the fourth day.

The paper is illustrated with over 300 figures, and gives so many technical details as to the structure and development of the skeleton, and as to the muscles of the wing, the brain, and the eye, that it is impossible here to give anything approaching a satisfactory abstract of the whole, which will appear shortly in the Philosophical Transactions. The chief results of more general interest, as bearing on the phylogeny of *Apteryx* and of the *Ratitæ* generally, may be briefly summarized as follows.

In stage A, the limbs have already attained their permanent position, so that, if the backward shifting of the appendages so noticeable in the chick occurs in *Apteryx*, it must take place at an unusually early period. In stage C, corresponding with a sixth-day chick, there is a well-marked operculum growing backwards from the hyoidean fold, and covering the third (? and fourth) visceral cleft. A rudiment of this structure is seen in the preceding stage.

From the first appearance of the feather papillæ there are well-marked pteryllæ and apteria, most of which can be made out with tolerable distinctness in the adult.

The wing of the adult has a well-marked pre- and postpatagium, and amongst its feathers may be distinguished nine or ten cubitals, two or three metacarpals, one mid-digital, and a row of rectrices majores. The barbicels of the feathers are slightly curved. The fore-limb passes through a stage in which it is a tridactyle paw with sub-

equal digits, followed by one (stage F) in which it is a typical wing with hypertrophied second and partially atrophied first and third digits. The variability of the muscles of the wing is noteworthy, and the evidences of degeneration are very clear; a number of wing-muscles, not mentioned by Owen, are described.

The nostril has acquired its final position at the end of the beak in stage E; up to the middle of incubation the whole respiratory region of the olfactory chamber, from the anterior nares to the commencement of the turbinals, is filled with a solid mass of epithelial cells, through which a passage is formed at a later period. The turbinals are unusually well developed. A pecten is present in the eye during late embryonic life. At no stage is there any trace of the caruncle or "egg-breaker" at the end of the beak.

As regards the skull, it may be mentioned that the head of the quadrate is provided with two articular facets; no intertrabecula could be observed; there is no interorbital septum; Jacobson's cartilages are present; and the hyoidean portion of the tongue-bone ossifies late, and is obviously degraded.

The vertebral column and hind-limb are typically avian, both as regards structure and development, and these typical characters appear early in the pelvis. There is a pygostyle. The sternum and shoulder-girdle, as well as the wing, are very variable, indicating degeneration; their position in stage E resembles that seen in Carinate birds. Vestigial acromial, procoracoid, and acrocoracoid processes are present, the procoracoid being well marked in comparatively late embryonic life. There is no trace of clavicles. A vestigial keel is occasionally present in the sternum; but before considering the peculiarities in the development of the sternum as of fundamental importance, it will be necessary to study that of the flightless Carinatæ, and especially of *Stringops*.

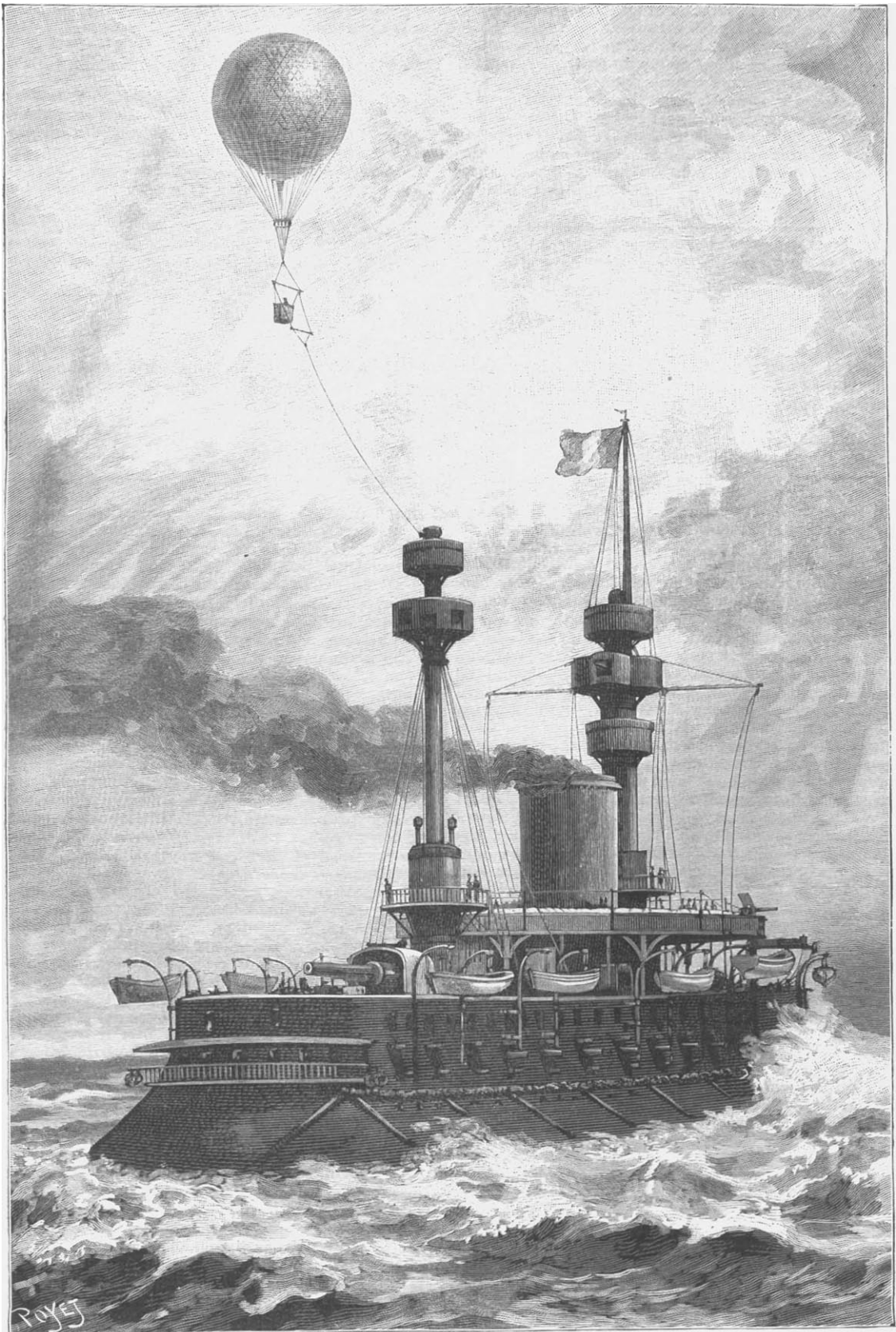
The brain passes through a typical avian stage with lateral optic lobes. The mesencephal is unusually small from the first; in stages D-F the optic lobes are dorsal; in G they become lateral by the transverse extension of the optic commissure or median portion of the roof of the mesocæle; in H they are already ventral, although larger proportionally than in the adult. The diencephal becomes tilted backwards in later stages, its dorsal wall becoming posterior, and the foramen of Monro posterodorsal instead of antero-dorsal. The anterior commissure and corpus callosum are large. The cerebral hemispheres are of unusual proportional length, and partly cover the cerebellum.

The greater number of the characters enumerated support the view that *Apteryx* is derived from a typical avian form capable of flight;¹ but on the other hand, the total absence of rectrices tells against this theory. Many characters, again, indicate derivation from a more generalized type than existing birds; while in other points *Apteryx* exhibits greater specialization than other birds. The general balance of evidence seems to point to the derivation of both *Ratitæ* and *Carinatæ* from an early group of typical flying birds or *Proto-Carinatæ*.

CAPTIVE BALLOONS.

SOME important experiments with captive balloons have lately been made in the Mediterranean squadron of the French navy. By the courtesy of the editor of *La Nature*, we are enabled to give, on the next page, a representation of the most interesting of these experiments, which was made on board the ironclad *Le Formidable*. All the officers who mounted in the car declare that it afforded an excellent point of observation. In clear weather they could distinguish, from Lagoubran, all the details of the coast from the entrance to Mar-

¹ The attitude assumed during sleep also supports this view.



Experiment with a captive balloon on board the French ironclad *Le Formidable*.
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seilles to the eastern extremity of the Islands of Hyères. No ship within a radius of from 30 to 40 kilometres could have escaped observation. With a cable of silk, the balloon could rise in calm weather to a height of 400 metres.

It is evident from the success of these experiments that captive balloons may be a most important aid to those who hereafter make use of them in naval warfare. The subject has attracted the attention of the naval authorities in Germany, and at Wilhelmshaven a captive balloon was sent up recently from the *Mars*. We are glad to learn that the English Admiralty has taken up the question.

THE COCO-DE-MER IN CULTIVATION.

WITH only one exception, the palms of the Seychelles have long since proved amenable to cultivation in our tropical plant-houses. The genera *Stevensonia*, *Verschaffeltia*, *Roscheria*, *Latania*, *Dictyosperma*, *Acanthophanix*, *Hyophorbe*, and *Chrysalidocarpus*, which are peculiar to this small group of islands, and which rank amongst the noblest of a noble family, are all well known in European collections of palms, their cultivation presenting no more difficulty than that of tropical plants generally. The coco-de-mer or double cocoa-nut (*Lodoicea seychellarum*) has, however, so far proved unmanageable under artificial treatment, notwithstanding that many attempts have been made to establish it at Kew and elsewhere. So long ago as the year 1827, Sir William Hooker published a series of figures and a description of the coco-de-mer in the *Botanical Magazine*, and recorded the arrival of living nuts of it at Kew, where, he says, "we cannot doubt of soon seeing them flourishing in our stoves." But they failed to grow, and although dozens of nuts have since been tried at Kew, not one ever got beyond the first stage of germination.

The absence from our collections of living examples of this most remarkable palm is most disappointing to all students of the order. At Kew we have lately been successful in establishing living plants of the Ita (*Mauritia flexuosa*) and Bussu (*Manicaria saccifera*) palms of the Demerara swamps, and the Doum (*Hyphæne thebaica*) and Palmyra (*Borassus flabelliformis*) palms of Africa. These successes stimulated the desire once more to obtain a living plant of the coco-de-mer.

Application was therefore made in January last year, through the Secretary of State for the Colonies, for a supply of fresh nuts from the Seychelles, and at the same time directions for packing and forwarding the nuts were sent to Mr. C. Button, the Conservator of Forests at those islands. The Administrator, Mr. T. Risely Griffith, took a warm interest in the matter, and through his kind exertions several consignments of nuts were received, of which four germinated. Two of these are probably too weak to live, but the other two are in a most promising condition. The strongest has a radicle 3 feet 8 inches long, and 12 inches in circumference at the end where the plumule is developed. This is now a foot long, and is pushing a perfect leaf.

In a note by the late General Gordon on the germination of the double cocoa-nut, it is stated that the nut is planted horizontally, without the husk, when it sends out a sprout some 12 feet long, which pushes up the young plant at a distance of 12 feet from the nut. The longest "sprout" we have had at Kew has not exceeded 4 feet. Nor can it be made to grow horizontally, the point turning down perpendicularly however often its position may be altered. At Kew the nuts were planted in a bed of cocoa-nut fibre, and kept at a temperature of 80°-85° F. They were planted in June 1889.

Mr. Button had kindly undertaken to plant a nut in a Wardian case, and treat it according to our instructions until it had germinated and developed the plumule before

despatching it to Kew. A nut thus treated arrived in July last in the most promising condition. The radicle is 1 foot 10 inches long, and the plumule is 7 inches in circumference at the base. It has a stout sheath-leaf, and a normal leaf 3 feet 2 inches long, 3 feet wide, with thirty-six folds. The midrib is curved, and the blade at present folded double. The texture is exceptionally firm, and the colour a deep green.

Full-sized trees of the coco-de-mer attain as much as 150 feet in height, with a smooth trunk about a foot in diameter. The leaves form an immense crown on the top, and each leaf is 20 feet long and 10 or 12 feet wide. The male and female flowers are on separate plants: the male inflorescence is shaped like a huge willow catkin, its length being 5 to 6 feet by 4 inches in diameter; the female is from 2 to 4 feet long, and it bears from six to ten fruits, each of which weighs from 25 to 30 pounds. They take seven years to mature, and sometimes hang two years on the tree after they are ripe. The process of germination extends over about two years. According to General Gordon, the trees begin to fruit when about forty years old, and attain maturity in 120 years.

Royal Gardens, Kew.

WILLIAM WATSON.

[The coco-de-mer is at present confined to Praslin and Curieuse, two of the islands of the northern group of the Seychelles Archipelago. It undoubtedly runs some risk of extinction from the long period which the nuts take to germinate, and from the fact that, the trees being of different sexes, isolated females may easily escape fertilization. Its cultivation in the Botanic Gardens of the tropics is therefore of considerable importance.]

Plants have long flourished in the Royal Botanic Gardens at Peradeniya, and the following extract from a letter from the Director, Dr. Trimen, F.R.S., to Kew, records the interesting circumstance of a male plant having flowered:—

"Peradeniya, August 12, 1890.

"You will be interested to hear that one of our *Lodoicea* palms put out a ♂ inflorescence last month. The tree is thirty-nine years old. To my great disgust, when the spike was about 6 inches long, some visitor cut it off with a blunt knife, and I found it on the ground. The flowers were all formed, and the structure exactly as described by Sir W. Hooker in the *Botanical Magazine*. I hope my other tree will prove ♀, but that is much younger."

Sir John Kirk also succeeded in establishing the palm in his garden at Zanzibar.

The Government of the Seychelles has long watched with care the preservation of the existing groves of the palm, and pains are now taken to fertilize the female plants artificially, and to plant the seeds.—W. T. D.]

NOTES.

WE have to announce the death of Pierre de Tchihatchef, which took place at Florence on the 13th ultimo. This gentleman was perhaps best known as a botanist, though his principal literary work, "*Asie Mineure: Description Physique, Statistique, et Archéologique de cette Contrée*," took a much wider range. Prior to 1857, he travelled ten years in Asia Minor and Armenia, and, besides the work named, he published a large number of separate papers on a variety of subjects, chiefly however on botany and geology, commencing in 1840. Like so many Russians, he appears to have been an accomplished linguist, and wrote German and French with equal facility. He resided some years in France, and was one of the original members of the Botanical Society of France, founded in 1854. His "*Botany of Asia Minor*" forms the third part of the work named above, and consists of two volumes of letterpress, and a volume of plates by Riocreux. Pierre de Tchihatchef was also the author of an